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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/828,437	04/21/2004	Shosuke Endoh	252112US2	5495

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EXAMINER

DHINGRA, RAKESH KUMAR

ART UNIT	PAPER NUMBER
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1792

NOTIFICATION DATE	DELIVERY MODE
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ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No. 10/828,437	Applicant(s) ENDOH ET AL.	
	Examiner RAKESH DHINGRA	Art Unit 1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 03 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 September 2009.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 4-8, 11, 13-15 and 18-32 is/are pending in the application.
- 4a) Of the above claim(s) 4-7, 11 and 22-27 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 8, 13-15, 18-21 and 28-32 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 15 November 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Arguments

Applicant's arguments with respect to claims 8, 13-15, 18-21 and 28-31 have been considered but are moot in view of the new ground(s) of rejection as explained hereunder.

Applicant has amended claim 8 by adding new limitations like “groove” and “filled into said groove which is covered by said focus ring in contact with said electrostatic chuck”.

Claims 4-8, 11, 13-15 and 18-32 are pending out of which claims 8, 13-15 and 18-21, 28-32 are presently active.

New reference by Ogahara (US 5,958,265) and reference by Nishikawa (JP 07-321184) when combined with Koshiishi read on amended claim 8 limitations. Accordingly claims 8, 18-21, 28 and 29 have been rejected under 35 USC 103 (a) as explained below. Further, remaining claims 13-15 and 30-32 have also been rejected under 35 USC 103 (a) as explained below. Applicant's arguments regarding Nishikawa (WO 02/065532) are moot in view of new grounds of rejection, as indicated above and detailed below under claim rejections.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to

which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 8, 18-21, 28 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ogahara (US 5,958,265) in view of Koshiishi et al (US PG PUB No. 2003/0106647) and Nishikawa (JP 07-321184).

Regarding Claim 8: Ogahara teaches a plasma apparatus comprising:

a holder main body (susceptor) 1 having an electrostatic chuck 2 on which is mounted an object 10 to be processed that is to be subjected to plasma processing, and a focus ring 9 having a contact surface disposed in contact with said electrostatic chuck 2 around a periphery of the object to be processed, said focus ring 9 being mounted on said electrostatic chuck 2, said electrostatic chuck having a chuck device 61 to which a chuck voltage is applied (from a DC source 64), and said electrostatic chuck attracting said focus ring by electrostatic attraction generated by the chuck voltage applied to said chuck device;

heat exchange means (a groove on the electrostatic chuck 2) provided at said contact surface, for carrying out heat exchange with said focus ring, said heat exchange means comprising a groove exposed to said contact surface and filled with a heat transfer medium (through a heat transfer gas supply path 71);

a chamber having said susceptor 1 therein, wherein:

said groove is formed in said electrostatic chuck 2;

said heat exchange means further comprises a supply path 71 that supplies the heat transfer medium to said contact surface (between focus ring 9 and electrostatic chuck 2).

Ogahara further teaches that pressure of the heat transfer gas is increased (non-zero pressure) to obtain increased cooling effect by the exchange of heat with the gas, and that there is no observed increase in temperature even as time passes due to accumulation of heat (e.g. Fig. 3 and col. 1, line 30 to col. 3, line 45 and col. 9, line 25 to col. 10, line 25).

Ogahara does not explicitly teach a controller that controls the chuck voltage applied to said chuck device, said controller changing the chuck voltage in accordance with each of multiple sequences of a plasma process; and that said controller sets the chuck voltage applied to the chuck device high during at least one processing sequence; and further that said controller is configured to control a pressure of the heat transfer medium supplied from said heat exchange means and configured to change the pressure of the heat transfer medium supplied in accordance with each of multiple steps of the plasma process; and still further that the controller is configured to set the pressure of the heat transfer medium filled into said groove which is covered by said focus ring in contact with said electrostatic chuck to a non-zero level during

conveying of the object to be processed into and out of said chamber so as to carry out cooling of said focus ring during conveying the object to be processed into and out of said chamber.

Koshiishi et al teach a plasma processing apparatus (Figs. 1, 4) comprising:

A susceptor 11 having an electrostatic chuck (through dielectric films 14a, 14b) on which is mounted a wafer W that is subjected to plasma processing and a focus ring 12 having a contact surface is disposed in contact with said electrostatic chuck around a periphery of wafer W, the focus ring 12 is mounted on the electrostatic chuck having a chucking device 11a, 11b to which a DC voltage 15 is applied and the focus ring is attracted by electrostatic attraction to the electrostatic chuck by the chucking voltage applied to the chucking device 11a, 11b;

a heat exchange means provided at the said contact surface for carrying out heat exchange with the focus ring 12, the heat exchange means comprising an opening (in the dielectric layer 14b for the heat transfer gas coming through passage 17) and filled with heat transfer medium, and further comprising a supply path (connecting portion of supply path 17 to the focus ring 12) that supplies a heat transfer gas to said contact surface. Koshiishi et al further teach that for attracting the wafer and the focus ring, different voltages are applied from power supply 15 through switch 24 that is controlled by a switch controller 25 (a controller) as per sequence of plasma processing of wafer (that is supply of voltage to chucking electrode 11a, for chucking the substrate during sequences of plasma processing is controlled by a controller) [e.g. Figs.1, 4 and para. 0038, 0043, 0055-0059]. It would be obvious to use the controller of Koshiishi et al in the apparatus of Ogahara to control the chuck voltage applied to the electrostatic chuck electrode as per sequence of process steps. Further, claim limitation “said controller sets the chuck voltage applied to the chuck device high during at least one processing

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sequence” is a functional limitation, and since the structure of prior art meets the structural limitations of the claim, the same is considered capable of meeting this limitation.

In this connection the courts have ruled:

While features of an apparatus may be recited either structurally or functionally, claims directed to an apparatus must be distinguished from the prior art in terms of structure rather than function. [In re Schreiber, 128 F.3d 1473, 1477-78, 44 USPQ2d 1429, 1431-32 (Fed. Cir. 1997)]

Ogahara in view of Koshiishi et al teach that pressure of the heat transfer gas is increased (non-zero pressure) to obtain increased cooling effect by the exchange of heat with the gas (Ogahara – col. 9, line 60 to col. 10, line 2), but do not explicitly teach the controller is configured to control a pressure of the heat transfer medium supplied from said heat exchange means and configured to change the pressure of the heat transfer medium supplied in accordance with each of multiple steps of the plasma process; and that the controller is configured to set the pressure of the heat transfer medium to a non-zero level during conveying of the object into and out of said chamber so as to carry out cooling of said focus ring during conveying the object to be processed into and out of said chamber.

Nishikawa teaches a substrate processing apparatus (Fig. 2) comprising an electrostatic chuck 12 with heat transfer gas supply holes 17 and a heat transfer gas supply path 18 which includes a gas source 19, gas rate controller 20, valve 22, temperature control unit 23 and a buffer tank 21. Nishikawa also teaches another embodiment (Fig. 7) comprising an electrostatic chuck 12 with plural supply paths 18a, 18b for supply of heat transfer gas to the peripheral and central regions of the electrostatic chuck 12. Nishikawa further teach that the buffer tank 21

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enables pressure of the heat transfer gas to be non-zero during conveyance of wafer W to be processed (e.g. Figs. 2, 7 and para. 0004, 0018, 0033, 0036, 0041, 0054). It would have been obvious to configure the controller of Ogahara in view of Koshiishi et al to keep the pressure of the heat transfer gas non-zero in view of teaching of Nishikawa to obtain increased cooling effect of the focus ring during conveying of the object to be processed from/into the process chamber.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to configure the controller to keep the pressure of the heat transfer gas as non-zero during conveying of the object to be processed from/into the process chamber as taught by Nishikawa in the apparatus of in Ogahara in view of Koshiishi et al to obtain increased cooling effect of the focus ring during wafer processing.

Regarding Claim 18: Koshiishi et al teach an electrode 11b built into the chuck device that faces the focus ring 12 (Fig. 4).

Regarding Claims 19, 20: Claim limitations reciting heat exchange means reducing temperature of focus ring to at least 20 degrees C below a temperature of the electrostatic chuck, and to a temperature not more than 0 degrees C are functional limitations, and since the apparatus of prior art meets the structural limitations of the claim, the same is considered capable of meeting the functional limitations (relevant case law already cited above under claim 8).

Regarding Claim 21: Nishikawa teaches the heat exchange means can circulate a heated heat transfer gas (which would heat the focus ring) {para. 0034}.

Regarding claim 28: Claim limitation “the supply path is evacuated when reducing a pressure inside said chamber” is a functional limitation and since the apparatus of prior art meets

the structural limitations of the claim, the same is considered capable of meeting the functional limitation (relevant case law already cited above under claim 8).

Regarding Claim 29: Claim limitation “wherein the pressure of the heat transfer gas is increased in accordance with incrementing of the chuck voltage during the process sequence” is a functional limitation and since the apparatus of prior art meets the structural limitations of the claim, the same is considered capable of meeting the functional limitation (Relevant case law already cited above under claim 8).

Claims 13, 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ogahara (US 5,958,265) in view of Koshiishi et al (US PG PUB No. 2003/0106647) and Nishikawa (JP 07-321184) as applied to claims 8, 18-21, 28 and 29 and further in view of Kanno et al (US 6,373,681).

Regarding Claim 13: Ogahara in view of Koshiishi et al and Nishikawa teach all limitations of the claim except the groove has a depth not less than 0.1 mm.

Kanno et al teach a plasma apparatus comprising an electrostatic chuck for supporting a wafer and where the electrostatic chuck has plurality of concentric grooves 46 provided on its top surface, for flowing a heat transfer gas between the wafer and the top surface of the electrostatic chuck. Kanno et al teach the depth of groove is 0.3 mm (meets the claim limitation of not less than 0.1 mm) [e.g. Fig. 14 and col. 17, line 60 to col. 18, line 40].

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide the electrostatic chuck with groove at the contact surface as taught by

Kanno et al in the apparatus of Ogahara in view of Koshiishi et al and Nishikawa to enable flow heat transfer gas and control temperature of the focus ring and the wafer.

Regarding Claim 14: Kanno et al teach the gas groove is formed in such a shape that a heat transfer gas for promoting cooling of a wafer during processing effectively flows over the entire back surface of the wafer and the groove pattern is capable of giving a desired temperature distribution to the wafer during processing (col. 18, lines 18 -45). It would be obvious to optimize the shape of the groove as per process limitations like to effectively flow the heat transfer gas over the entire back surface of the wafer and giving a desired temperature distribution to the wafer during processing.

Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ogahara (US 5,958,265) in view of Koshiishi et al (US PG PUB No. 2003/0106647) and Nishikawa (JP 07-321184) as applied to claims 8, 18-21, 28 and 29 and further in view of Masuda et al (US 2002/0005252).

Regarding Claim 15: Ogahara in view of Koshiishi et al and Nishikawa teach all limitations of the claim including that holes 16 for heat transfer gas (Fig. 9 – Nishikawa) are in concentric circle shape, but do not explicitly teach the groove is annular shaped concentric with the focus ring.

Masuda et al teach a plasma apparatus comprising a processing chamber 100 with an electrostatic chuck 131 for supporting a wafer W and where the electrostatic chuck has plurality of concentric grooves 136, 136B provided on its top surface and where groove 136B is exposed to the contact surface between the ring 132, 133 and the electrostatic chuck 131, and where the

groove 136B is filled with a heat transfer gas. Masuda et al further teach the grooves 136 comprise annular shape concentric with the focus ring 132 (e.g. Fig. 1, 2 and para. 0065-0067).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide the electrostatic chuck with groove of annular shape as taught by Masuda et al in the apparatus of Ogahara in view of Koshiishi et al and Nishikawa to enable provide heat transfer gas uniformly over the rear surface of the substrate.

Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ogahara (US 5,958,265) in view of Koshiishi et al (US PG PUB No. 2003/0106647) and Nishikawa (JP 07-321184) as applied to Claims 8, 18-21, 28, 29 and further in view of Hasegawa et al (US 5,556,500).

Regarding Claim 30: Ogahara in view of Koshiishi et al and Nishikawa teach all limitations of the claim except a heating member in contact with said focus ring and covering at least an outer peripheral surface of said focus ring.

Hasegawa et al teach a plasma apparatus with a processing chamber 12 that includes a focus ring 114 and a heating member 116 in contact with outer peripheral surface of the focus ring 114. Hasegawa et al also teach a cylindrical body 124 that surrounds the focus ring 114 and also control the heating of focus ring 114 (e.g. Figs. 6, 7 and col. 9, line 52 to col. 10, line 14). Hasegawa et al does not explicitly teach that heating member 116 covers the outer peripheral surface of focus ring, but teaches that shape of the same is optimized to reduce the deposition of reaction products on the individual parts like focus ring etc.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to provide a heating member in contact with focus ring and whose shape is optimized as taught by Hasegawa et al in the apparatus of Ogara in view of Koshiishi et al and Nishikawa to enable control the temperature of the focus ring and minimize the deposition of reaction products on the focus ring.

Claim 31, 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ogahara (US 5,958,265) in view of Koshiishi et al (US PG PUB No. 2003/0106647) and Nishikawa (JP 07-321184) as applied to Claims 8, 18-21, 28, 29 and further in view of Birang et al (US 5,491,603).

Regarding Claims 31, 32: Ogahara in view of Koshiishi et al and Nishikawa teach all limitations of the claim except the controller is configured to control the chuck voltage to maintain a same polarity during the at least one processing sequence as during conveying the object from the chamber, and the controller is configured to control the chuck voltage to a first non-zero level during processing and configured to control the chuck voltage to a second non-zero level during conveying of the object into and out of said chamber.

Birang et al teach a plasma apparatus comprising a heat exchange gas system for an electrostatic chuck that includes a pressure transducer 240, a flow controller 230 and a controller 250. Birang et al further teach that the controller 250 enables control of chucking/dechucking voltage applied to electrostatic chuck. Birang et al also teach that a positive voltage of 2000V (non-zero voltage) is applied to electrostatic chuck during wafer's conveyance (before the wafer is place on the chuck (that is during conveyance of the wafer) and further during processing also

a positive voltage (non-zero voltage) is applied for chucking (since the wafer bias adds to the chucking voltage) [e.g. Fig. 2 and col. 3, lines 35-65].

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to configure the controller to control the chuck voltage to maintain a same polarity during the at least one processing sequence as during conveying the object from the chamber and apply non-zero voltages during the conveyance of wafer and during wafer processing as taught by Birang et al in the apparatus of Ogahara in view of Koshiishi et al and Nishikawa to obtain effective chucking of wafer to the substrate during processing.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RAKESH DHINGRA whose telephone number is (571)272-5959. The examiner can normally be reached on 8:30 - 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/R. D./
Examiner, Art Unit 1792

/Karla Moore/
Primary Examiner, Art Unit 1792